MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

FISHERY INVESTIGATIONS

Series II *Volume* XXII *Number* 2

Echo-Sounder Surveys in the Autumn of 1956

D. S. TUNGATE

Fisheries Laboratory, Lowestoft

LONDON: HER MAJESTY'S STATIONERY OFFICE

1958

Digitized by the Internet Archive
in 2025

https://archive.org/details/fishery-investigations-series-ii_1958_22_2

Echo-Sounder Surveys in the Autumn of 1956

D. S. TUNGATE

INTRODUCTION

THE herring industry suffered badly in 1955 due to the absence of good catches on the East Anglian grounds. In 1956, in order to provide more searching power for the diminishing drifter fleet, the R.V. PLATESSA was used to make a series of echo-sounder surveys, starting in September and continuing until mid-November. Skippers were informed that the PLATESSA would broadcast information at specified times during the days spent at sea. On the completion of each cruise, charts showing the results were displayed on the Ministry's notice board on the Lowestoft fish market.

My colleague Mr. J. P. Bridger and other naturalists-in-charge of cruises did much to shape this work. It fell to me to complete and report on it.

METHODS OF ESTIMATING FISH DENSITY

ALL estimates of fish density were based on traces obtained with the Kelvin Hughes MS 24 echo-sounder.

The solid plume traces (Plate 1a) were measured in millimetres across the widest part and the flecky traces (Plate 1b) estimated by counting each fleck produced by one stroke of the stylus. As each fleck measured on the average one third of a millimetre across, an equivalent assessment was made by counting the flecks and dividing by three to give width of trace in millimetres. Position of the ship was found by Decca navigator every half hour; it had usually travelled four miles in that time. Traces were contoured in units of millimetres per mile.

The contour levels used for the echo traces were 1, 5 and 10 mm. per mile.

Drifters' positions and the average night's catch per drifter were also plotted in statistical rectangles of 10 miles by 6 miles.

The contour levels used were 1, 50 and 100 crans per boat.

The echo survey is most easily regarded as a single distribution for the period of the cruise. But one patch of traces may be found on one day and another patch three days later. In relating the catch of drifters to the echo patches, all catches in the small area of the patch have been plotted for the whole cruise period. So in Fig. 1a there is an echo patch off Whitby which was recorded on September 18th and 19th; in Fig. 1b all catches from the area of this patch for the period September 14-20 are plotted. The reason for this is that if a single distribution is justifiable from September 14-20, the patch sampled on September 18 and 19 is assumed not to have moved very much. In most cases, the coincidence of patches with drifter's catches will show that this is a reasonable assumption. In judging the degree of coincidence, it is to be remembered that exact superposition of the two sets of data is not to be expected.

RESULTS

ECHO surveys were made by the following naturalists-in-charge in R.V. PLATESSA from the latitude of Whitby to the Straits of Dover.

Cruise XIII September 14th-27th, 1956 (J. P. Bridger)
,, XIV October 8th-14th, 1956 (D. S. Tungate)
,, XV October 18th-25th, 1956 (F. R. H. Jones)
,, XVI November 1st-7th 1956 (G. Bolster)
,, XVII November 15th-19th, 1956 (F. R. H. Jones)

Cruise XIII–PLATESSA, *September 14th-27th*

This cruise covered a large area from Smith's Knoll in the south to Whitby in the north and extended east to 3° of longitude; the tracks were 15 miles apart. The ship steamed twice over this area. If we refer to Figs. 1a and 1b describing the first grid (September 14-20), we will find that the landings of herring from the Whitby area coincided very well with a dense echo patch (10 mm + per mile) which stretched from Hartlepool to Filey and which extended about ten miles from the coast on September 18th and 19th. On the 16th and 17th several ships had catches of over 50 crans in that area, while drifters that fished on the grounds nearer to North Shields had consistently low catches.

Turning to Fig. 2a, dense concentrations of fish extending out from Flamborough Head to 3° of longitude were found on the second grid. It is possible that the patch found on the S.W. patch of the Dogger were Dogger Bank spawners. No British drifters were fishing in that area; they were still fishing the Whitby (Fig. 2b) and North Shields grounds. Good echo traces north of the Broken Bank (discovered on the first grid) had intensified and had become larger on the second grid and a medium concentration (5-10 mm per mile) appeared on this second survey coming in over the Leman ground and extending south over the Winterton Twenties. Two drifters fished on the Well Bank Flat on the nights of the 23rd, 24th and 25th September, but unfortunately did not have good catches; they had shot in an area which echo survey had shown to be poor (Fig. 2c).

On Fig. 2a a black arrow is drawn, denoting some southerly movement from the Whitby patch shown in Fig. 1a to the Flamborough Head patch shown in Fig. 2a. Such movements are difficult to infer and are only tentative; the appearance of patches north, west and south-east of the Norfolk Banks on this second grid of Cruise XIII in an area which was more or less empty on the earlier cruise is not taken to indicate any movements because no direction can be attached to them.

Cruise XIV–PLATESSA, *October 8th-14th*

Grid 1. This grid extended from Aldeburgh in the south to the Outer Dowsing Light Vessel in the north, and east to 3°30′E of longitude, with tracks 15 miles apart (Fig. 3a).

Grid 11. This covered mainly the local East Anglian grounds with tracks 7½ miles apart, making a rather more concentrated grid than the previous one (Fig. 4a).

Grid 111. Covered approximately the same area as the main part of Grid 11 (Fig. 4b).

Cruise XVI–PLATESSA, *November 1st-7th*

Extremely bad weather conditions were experienced on this cruise and no traces at all were found in the area south-east of Lowestoft (Figs. 7a and 7b).

On November 5th light catches were recorded from all over the local grounds, but good catches were made in the region of the North Hinder, where good echo traces were found.

Cruise XVII–PLATESSA, *November 15th-19th*

This cruise was concentrated on the Fairy Bank and the Cape grounds and two grids were steamed over that area.

The first grid (November 15th-17th, Fig. 8a) shows that there were very good fish shoals extending from the Fairy Bank right into the mouth of the English Channel, but the drifters were still fishing the local grounds with little success. One or two had tried the Hinder and Fairy Bank and had good catches. On the second grid (November 18th, Fig. 8b), the dense fish shoals found on the first grid were found to have dispersed somewhat. Only a few drifters tried the Cape grounds and they met with little success. The Smith's Knoll grounds proved to be even less fruitful for the drifters still fishing there.

The first grid of this cruise (Fig. 3a) shows that there were concentrations of fish on the Winterton Twenties and Smith's Knoll grounds. Drifters were fishing to the north of this area and averaging less than 50 crans, but it is to be seen that the ships that fished near where our survey had shown good fish traces, had catches of well over 50 crans per drifter (Fig. 3b). Comparing this survey with that illustrated in Fig. 2a, it is reasonable to show a general movement southward from the north-west and some movement in from the north-east. On the second grid, best concentrations of fish were found by PLATESSA 10 miles south of Smith's Knoll (Fig. 4a.) This information was broadcast to the drifters on the morning of the 12th October. Three drifters decided to go and fish in that area, with the result that they had catches of 179, 110 and 60 crans. These proved to be the highest catches caught up till that time on the local grounds. The movement between the two surveys again appears to consist of a north-west component across the Norfolk Banks and a north-east component further south. The third and last grid of this cruise (Fig. 4b) shows that the fish shoals had moved southward, but the drifters had concentrated on the area where the drifters hauled good catches on the 12th.

Cruise XV–PLATESSA, *October 18th-25th*

Two grids were made in the area, October 18th-21st (Figs. 5a and 5b) and October 22nd-25th (Figs. 6a and 6b).

On the first grid fairly good fish shoals did appear on the Smith's Knoll grounds, but elsewhere traces were rather thin; however good concentrations of fish appeared on the Hinder Grounds to the south and there were no drifters fishing there. Drifters were still finding good quantities of fish on October 19th, 20th and 21st in the areas coinciding with passable to good echo traces in the Smith's Knoll and Winterton Twenties grounds. The first grid covered a wide area and comparing the distribution of echo patches with that of the previous two surveys, it is clear that a major movement had taken place to the southward. The second grid of this cruise (Fig. 6a) was concentrated on the local area. It shows that there were still good shoals south of Smith's Knoll; in fact the night of the 22nd October produced some of the best catches of the season. Good traces were still found towards the Hinder grounds.

MOVEMENTS OF ECHO PATCHES

THE main movements of the echo patches may be summarized as follows:

Cruise XIV PLATESSA–Figs. 3a, 4a and 4b show that the main trend is still south-east, but there is another echo patch moving in a south-westerly direction over the Brown Bank grounds.

Cruise XV PLATESSA–Figs. 5a and 6a indicate a steady southward movement of the echo patches over the Smith's Knoll and Hinder grounds.

Cruise XVI PLATESSA–Fig. 7a, the southward movement continues.

Cruise XVII PLATESSA–Figs. 8a and 8b, this cruise shows that the echo patches have become concentrated in the narrow bottle-neck of the entrance to the English Channel.

Fig. 9 shows all the arrows plotted on one chart, demonstrating a steady southward movement.

The Winterton Twenties appears to be a meeting point for more than one stream of fish, some coming from the north-west and the others from the north-east. From the Smith's Knoll grounds the fish again moved south in a dispersed manner until they reached the Gabbard and North Hinder grounds. Then until they reached the English Channel, the fish moved in dense shoals over the probable spawning grounds.

In most cases the echo patches migrated south at the rate of between $1\frac{1}{2}$ to 2 miles a day. The shoals coming in to the Knoll grounds from the north-east moved at a higher rate, but I think that can be explained by the N.E. winds experienced at that time.

SUMMARY

THIS series of echo surveys has shown that the research ships can help the fisherman to find the herring. As will be seen by a careful study of the charts of the various cruises, the herring shoals move considerably in 24 hours. A good example of this can be seen by referring to Fig. 4a. On the morning of the 12th October the PLATESSA found good fish traces 10 miles south of Smith's Knoll and that information was immediately passed on to the drifters by ship's radio. That night only three drifters fished in that area, but they caught 179, 110 and 60 crans of herring which were at that date the best catches of the East Anglian season; in fact the 179 crans shot was in line for the Prunier trophy. The next night all the drifter fleet moved down into that area, but by that time the fish shoals had moved further south-east and they were fishing in an area that our next survey on the 14th October (Fig. 4b) proved to be poor in fish traces.

As a result of this work the movement of herring passing through the Southern Bight has been traced continuously. At least the bulk of the herrings appear to travel southward through the sand banks known as the Swatchways and they travel through these banks until they reach the Smith's Knoll grounds. The shoals then move south in the line of the Knoll stream until they reach the Gabbard and Hinder grounds. It appears that the Smith's Knoll and the Hinder Sandettie region are areas of concentration. The second is now known as the main spawning area of the whole Downs stock. In most cases the rate of migration southward of the various shoals is between $1\frac{1}{2}$ to 2 miles per day.

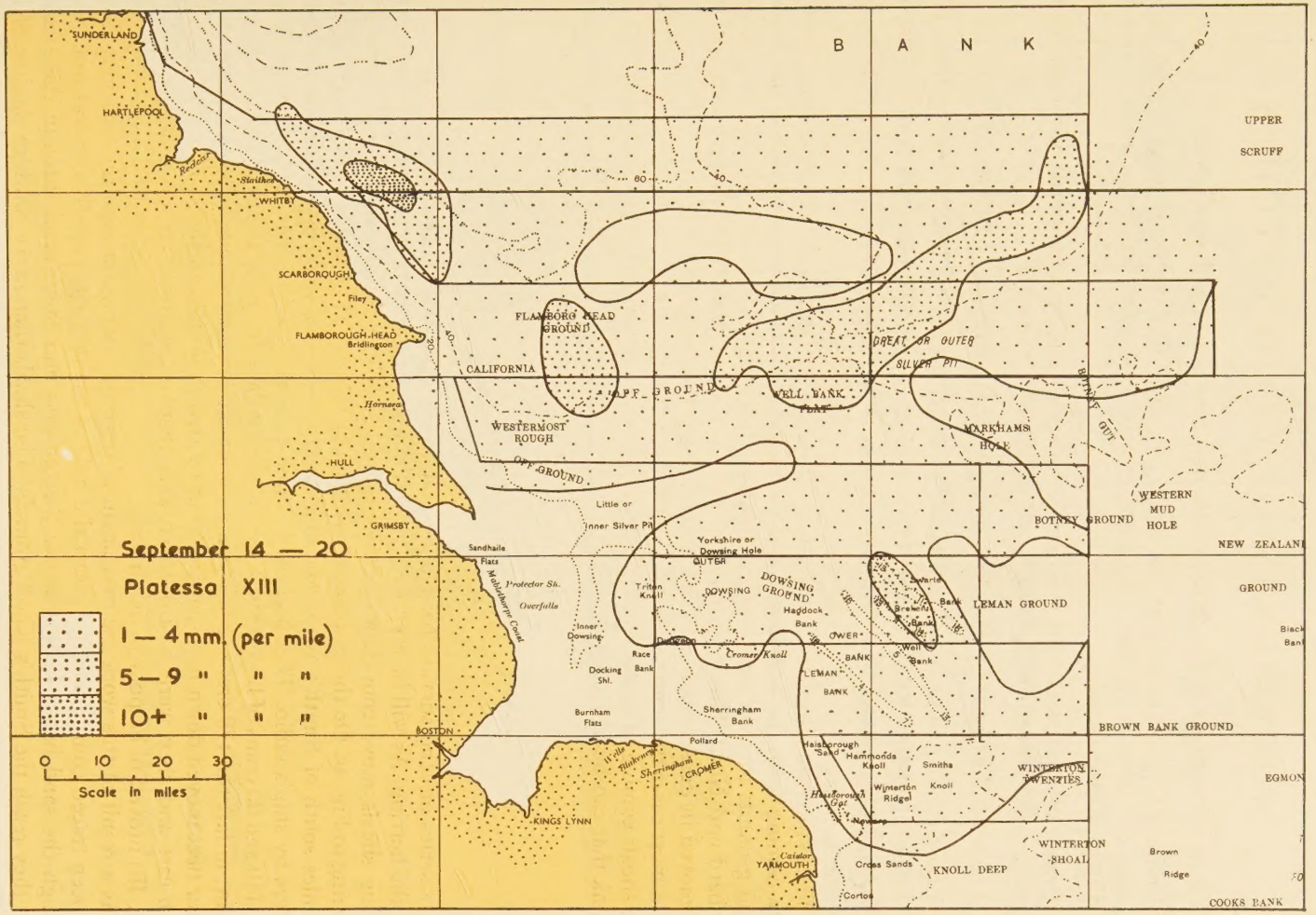


Fig. 1a. *PLATESSA Cruise XIII. Area covered by first survey*

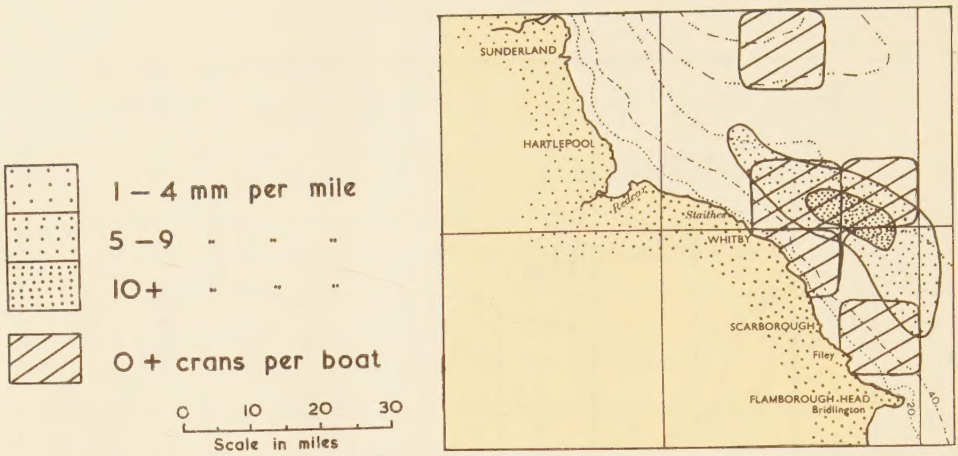


Fig. 1b. *PLATESSA Cruise XIII. Area surveyed September 18th-20th*
Diagonal lined area fished by drifters on the nights of September 14, 16, 17, 18, 19 and 20

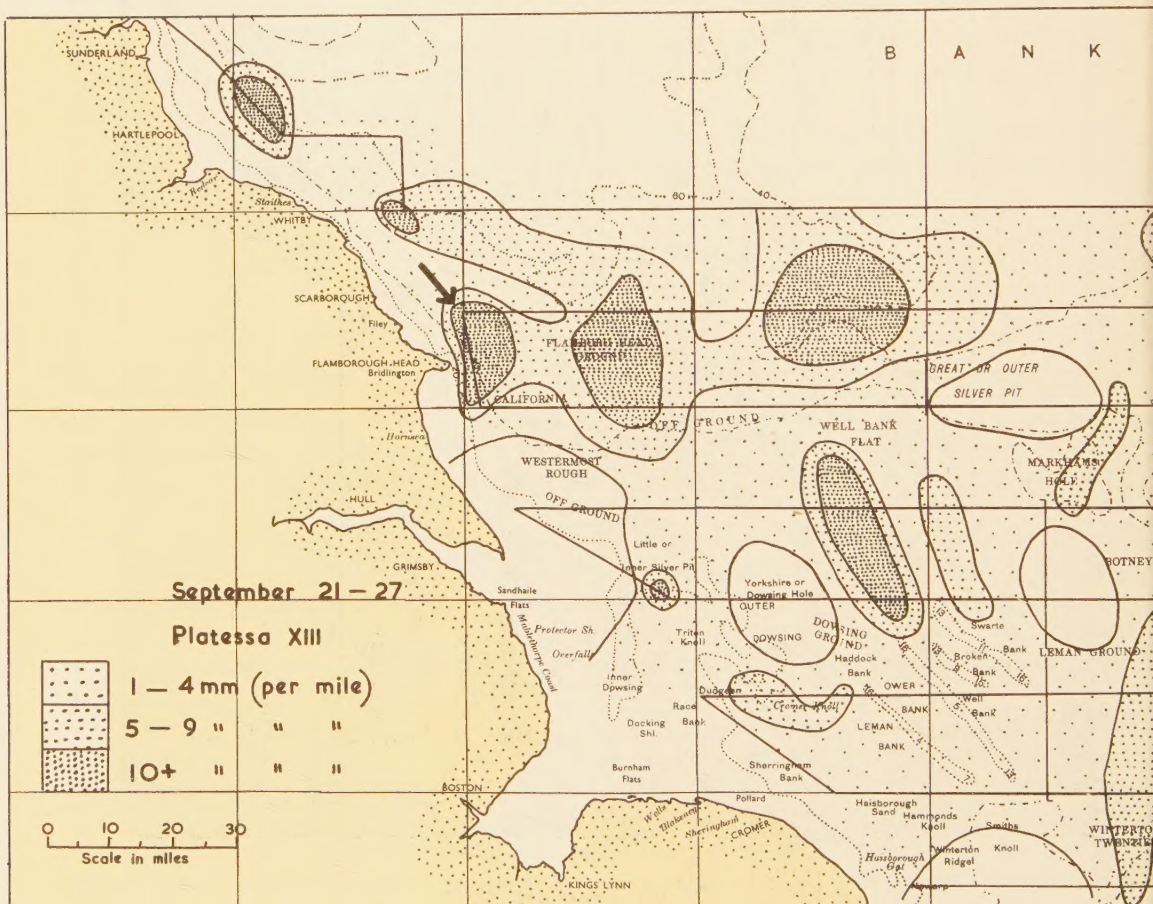


Fig. 2a. *PLATESSA Cruise XIII. Area covered by second survey*
Arrow indicates probable movement of echo patches

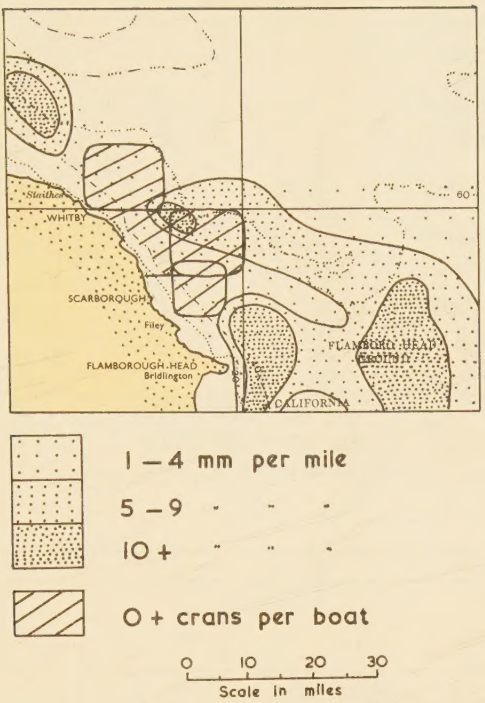


Fig. 2b. *PLATESSA Cruise XIII. Area surveyed September 21st-22nd*
Diagonal lined area fished by drifters on the nights of September 21, 23, 24 and 27

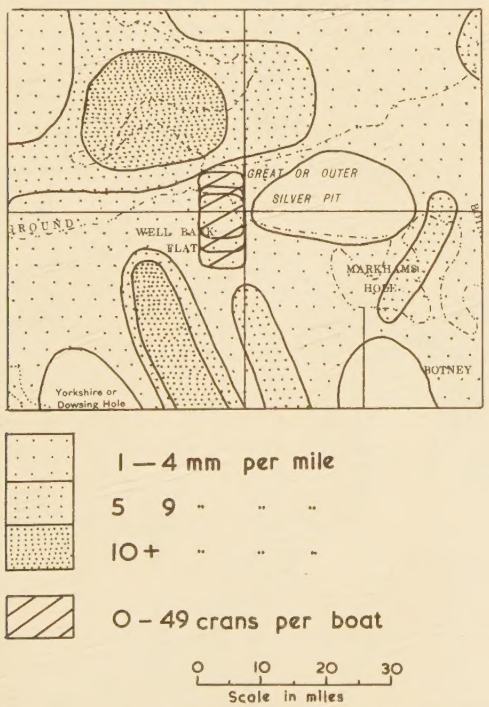


Fig. 2c. *PLATESSA Cruise XIII. Area surveyed September 22nd-25th*
Diagonal lined area fished by drifters on the nights of September 23, 24 and 25

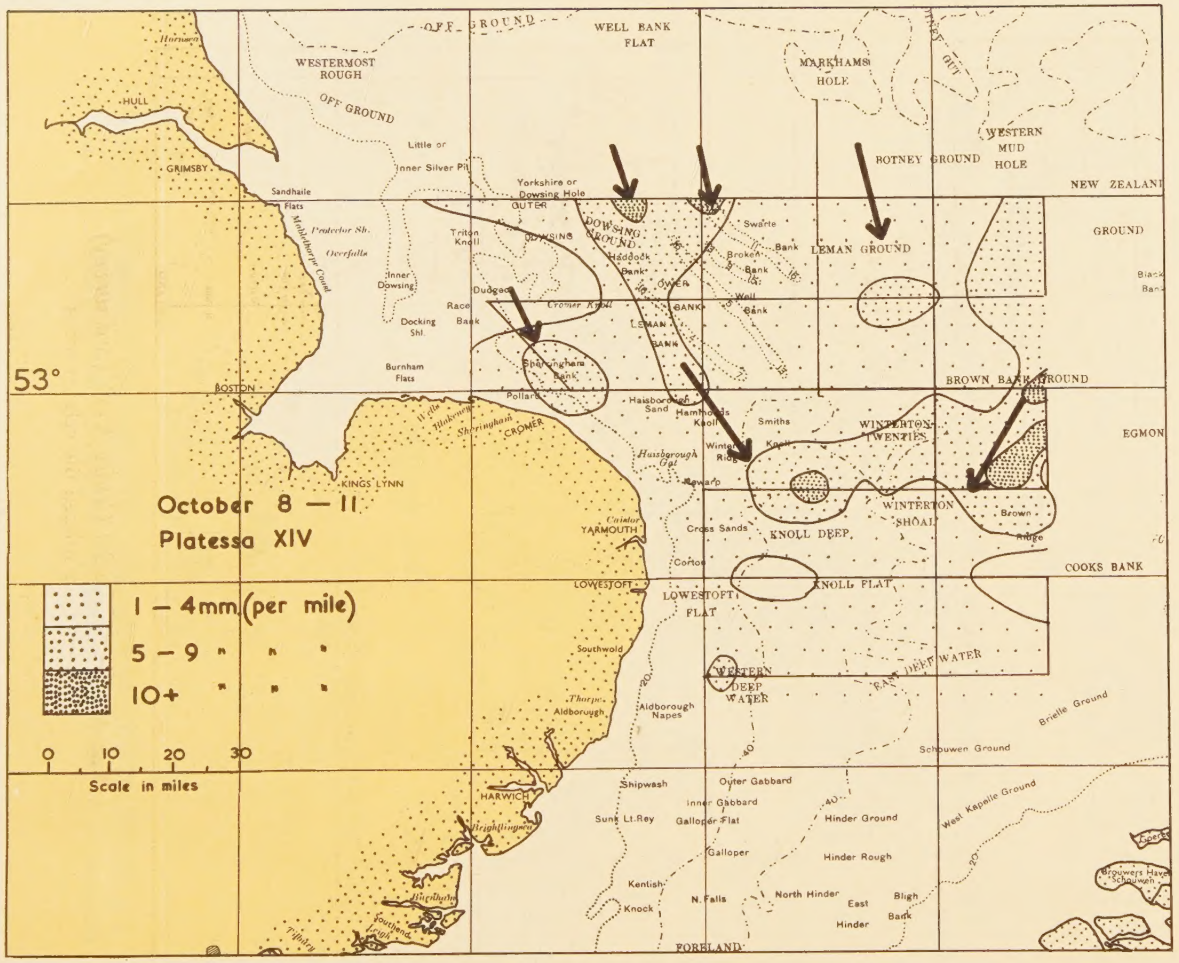


Fig. 3a. *PLATESSA Cruise XIV. Area covered by first survey*

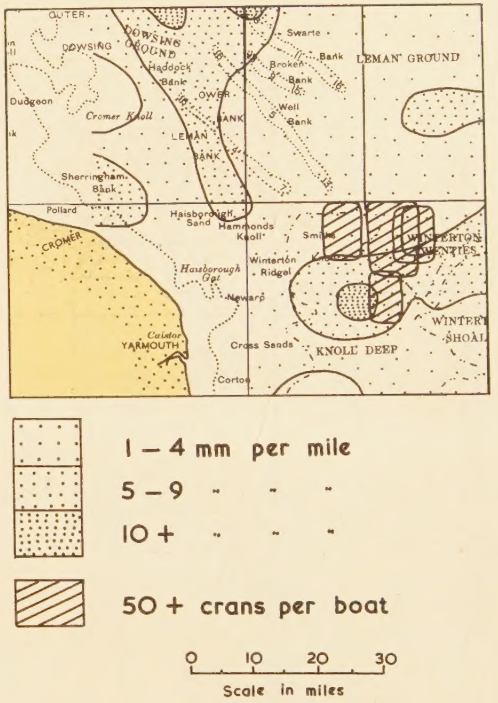


Fig. 3b. *PLATESSA Cruise XIV*
Area surveyed October 8th-11th
Diagonal lined area fished by drifters on the nights of October 8, 9, 10 and 11

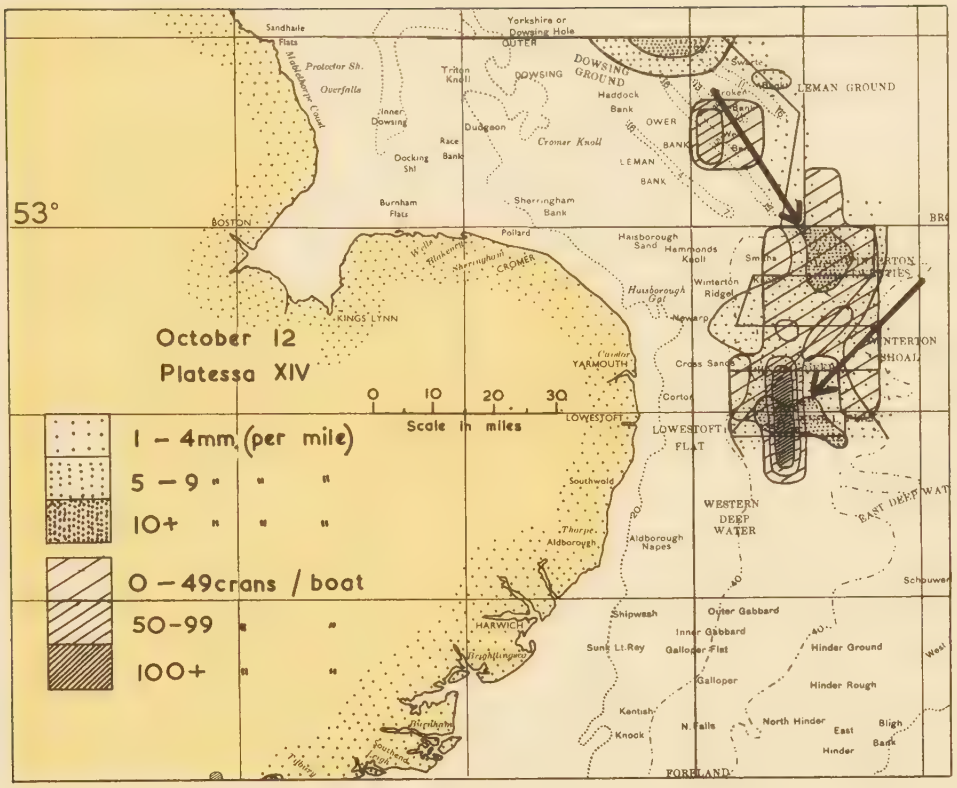


Fig. 4a. *PLATESSA Cruise XIV.* (*2nd survey*)
Lower echo patch discovered by PLATESSA, coinciding with high catches on the night of October 12

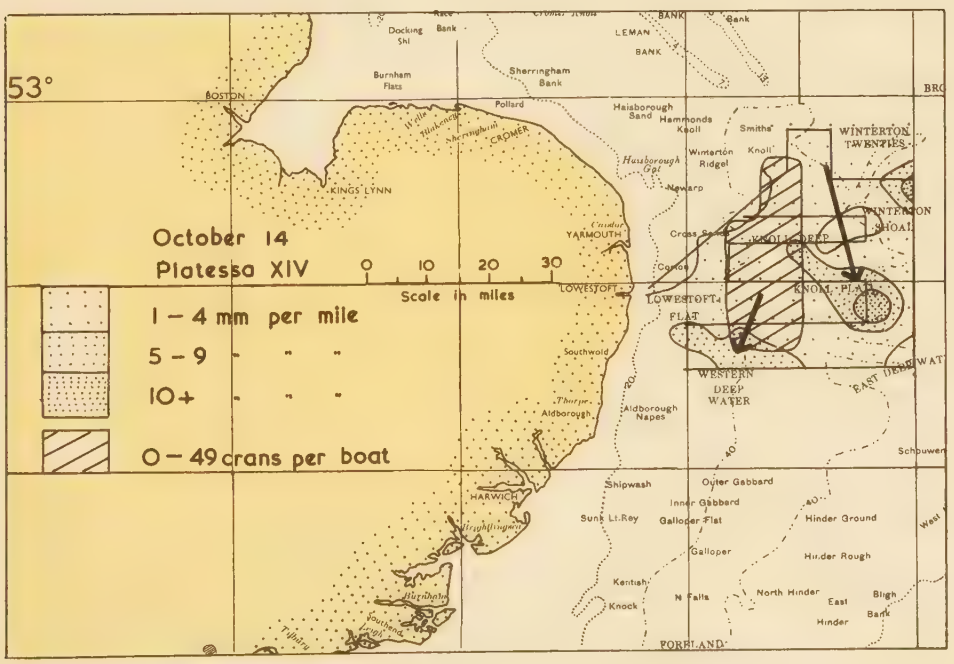


Fig. 4b. *PLATESSA Cruise XIV.* (*3rd survey*)
Drifters have missed the echo patches

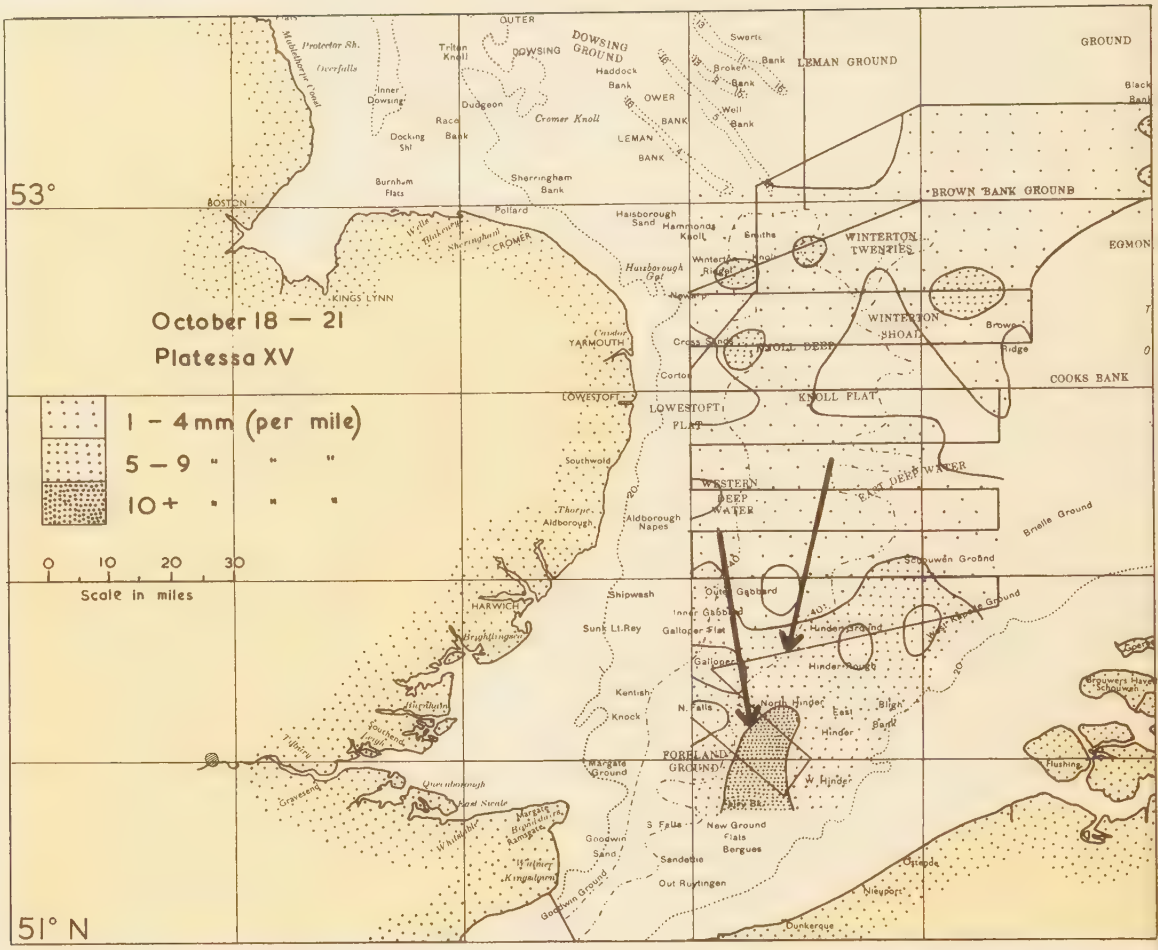
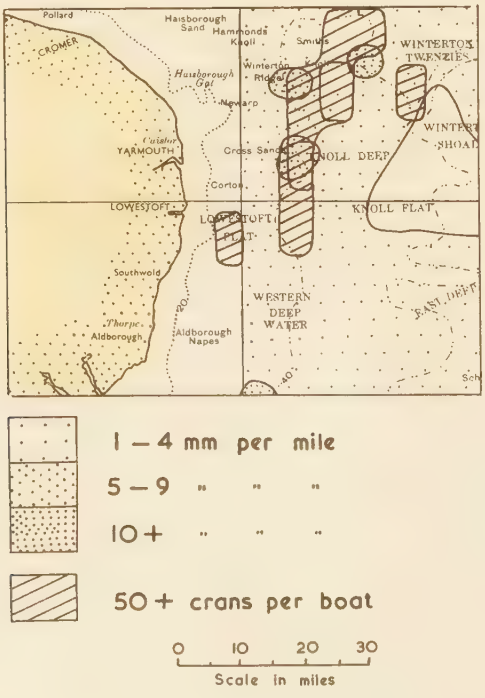


Fig. 5a. *PLATESSA Cruise XV*
Area covered by first survey



5b. *PLATESSA Cruise XV*
Area surveyed October 18th-20th
Diagonal lined area fished by drifters on the nights of October 18, 19 and 20

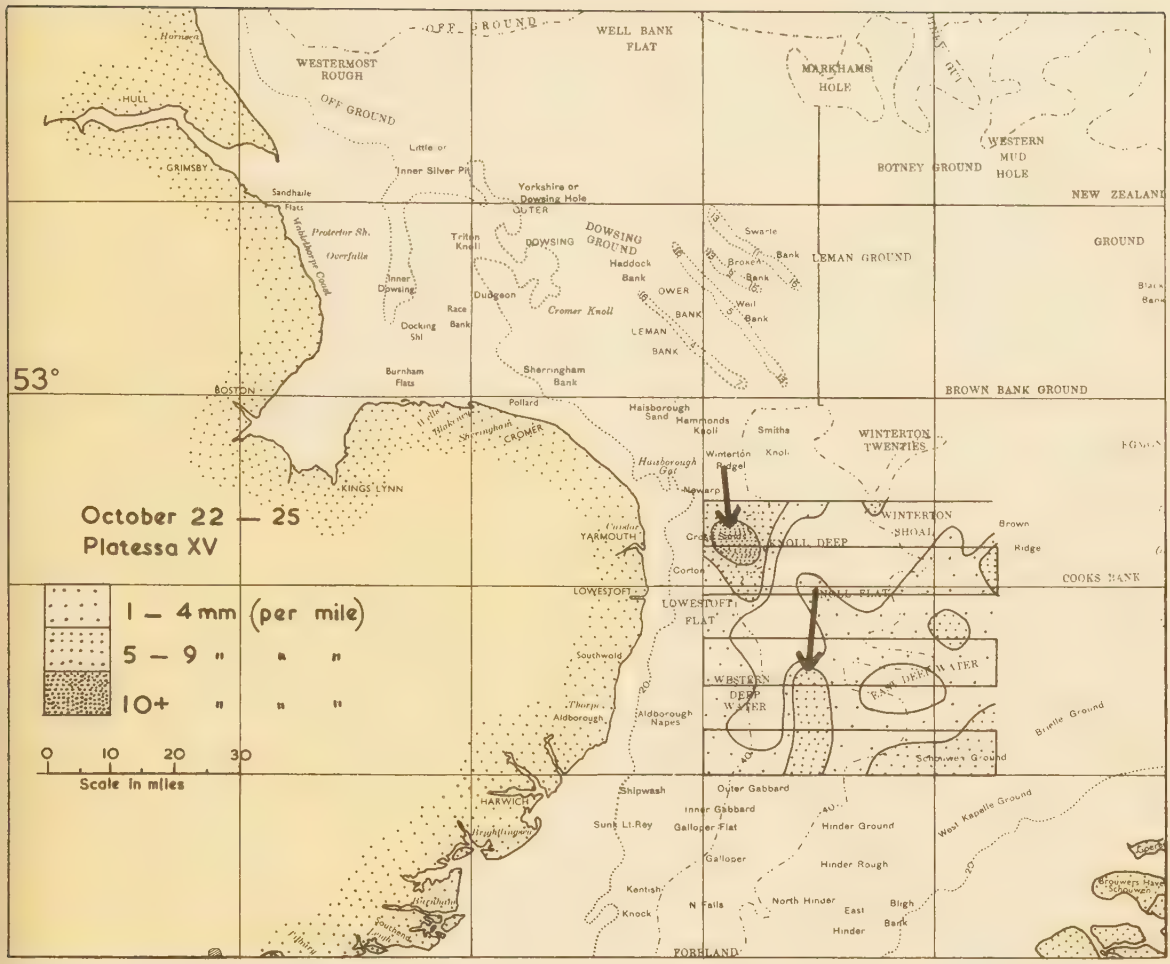


Fig. 6a. *PLATESSA Cruise XV*
Area covered by second survey

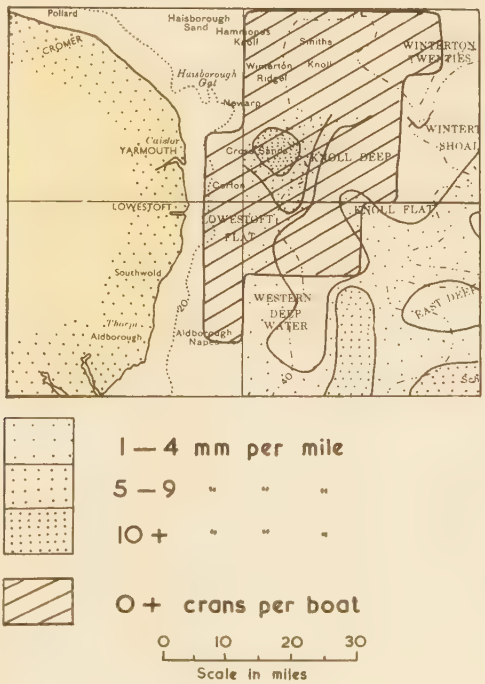


Fig. 6b. *PLATESSA Cruise XV*
Area surveyed October 22nd-25th
Diagonal lined area fished by drifters on the nights of October 22, 23, 24 and 25

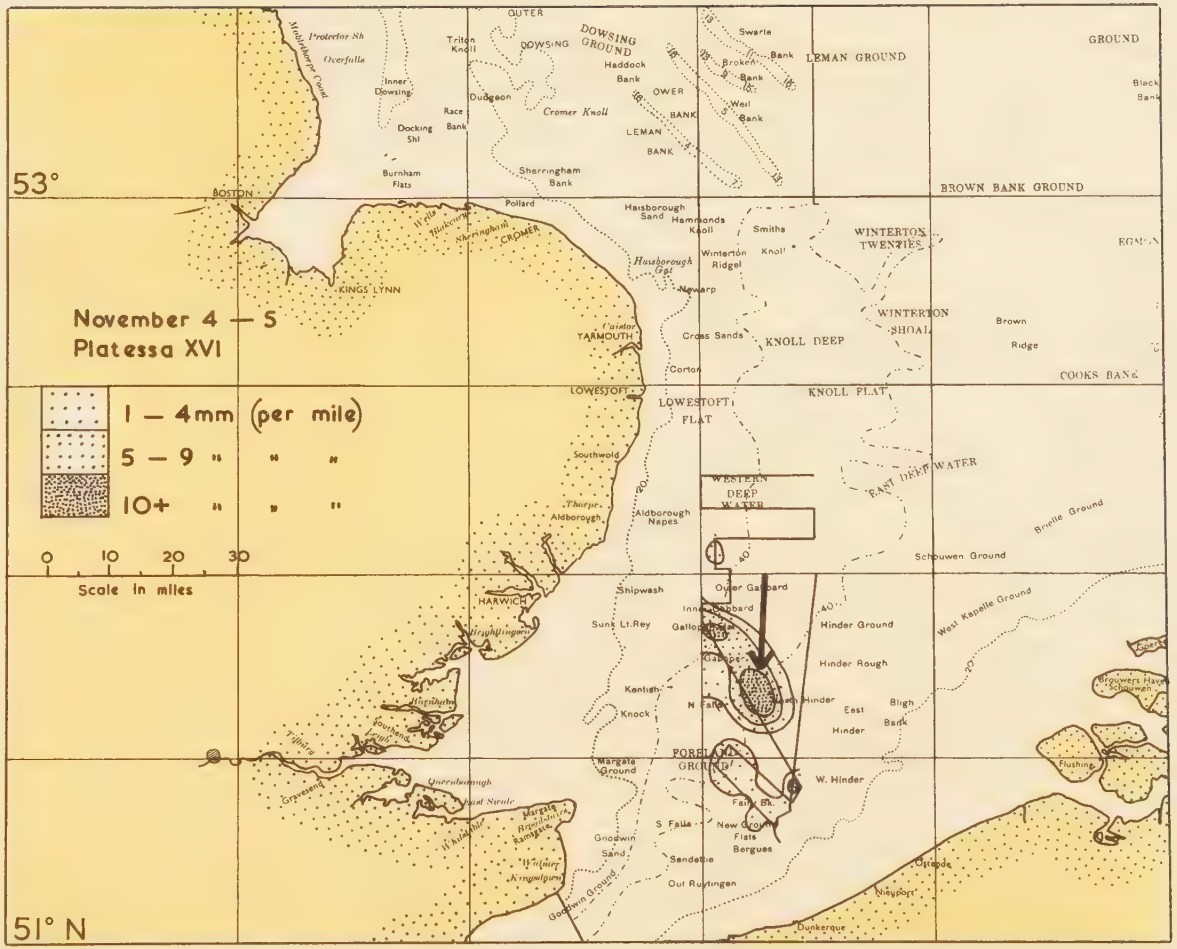


Fig. 7a. *PLATESSA Cruise XVI*

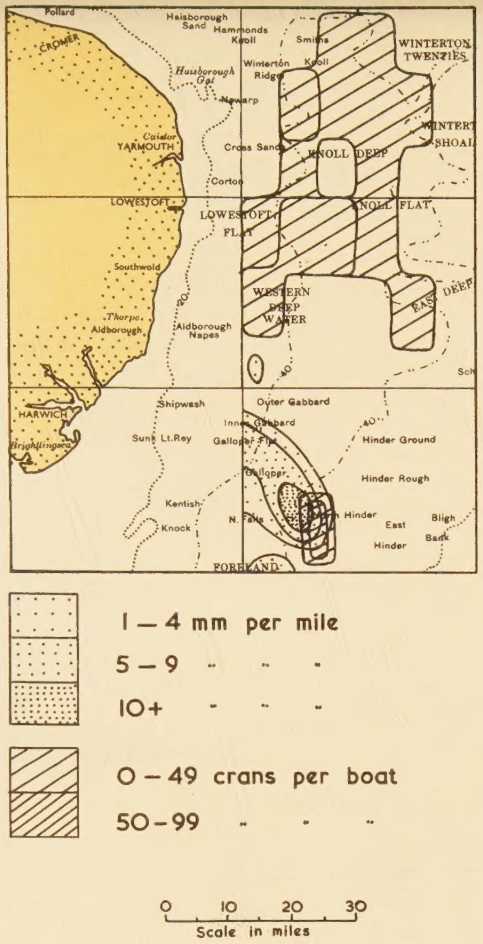


Fig. 7b. *PLATESSA Cruise XVI*

Area surveyed November 4th-5th.

Diagonal lined area fished by drifters on the nights of November 4 and 5

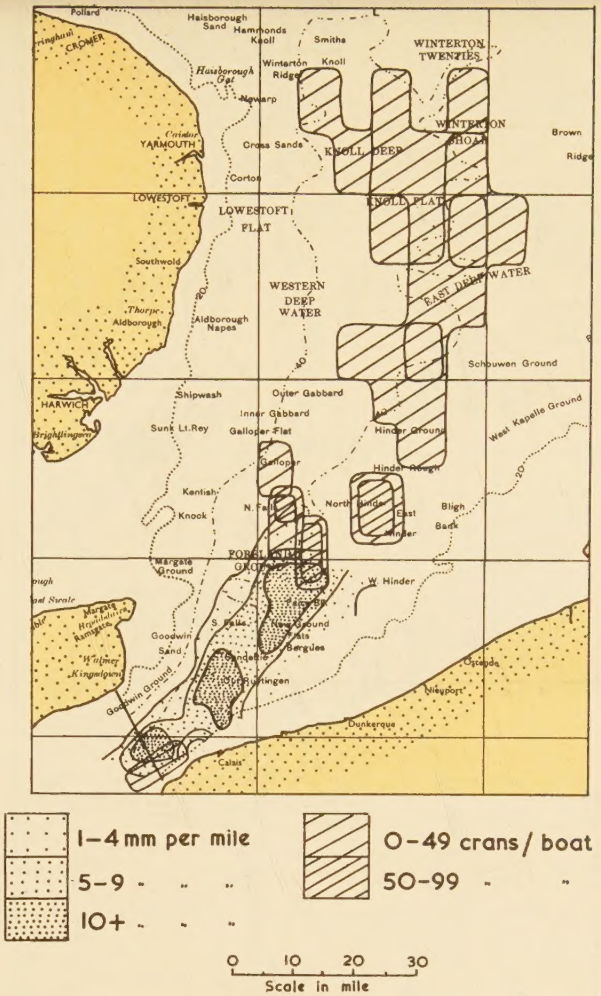


Fig. 8a. *PLATESSA Cruise XVII*

Area surveyed November 15th-17th

Diagonal lined area fished by drifters

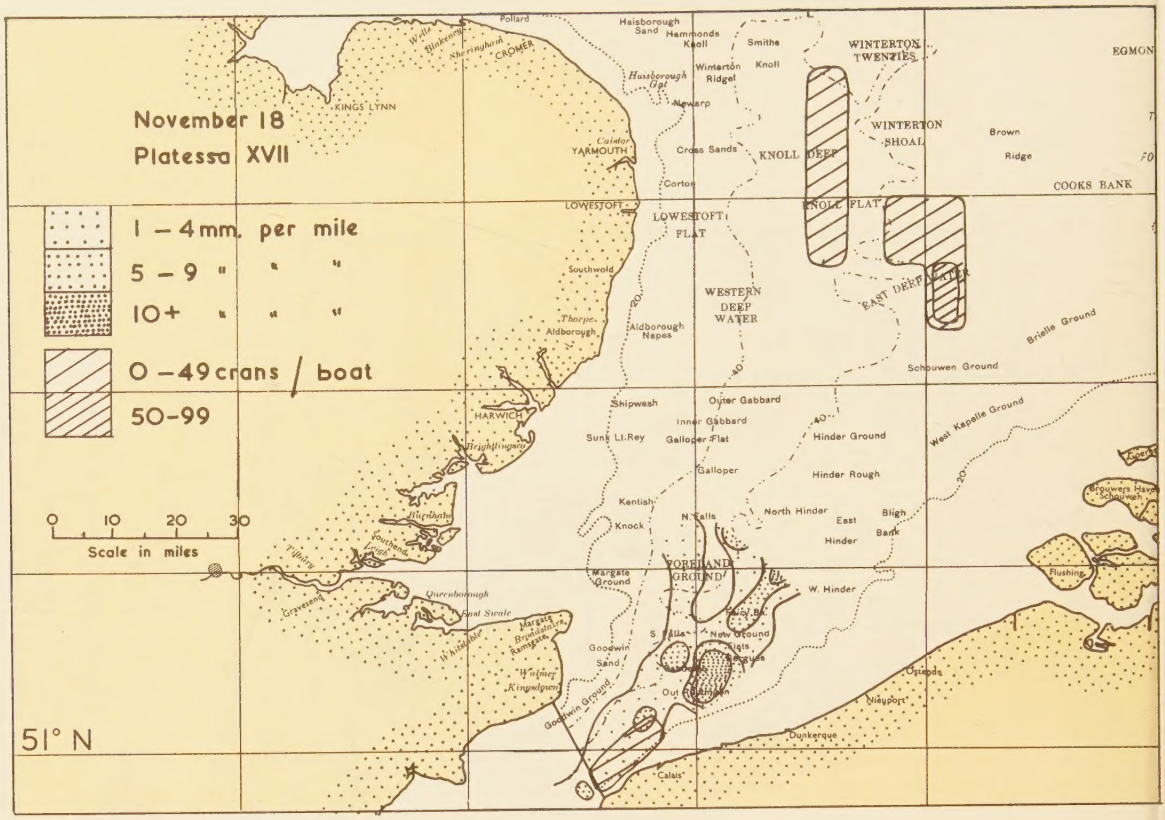


Fig. 8b. *PLATESSA Cruise XVII*
Echo patches have decreased. East Anglian fishery almost finished

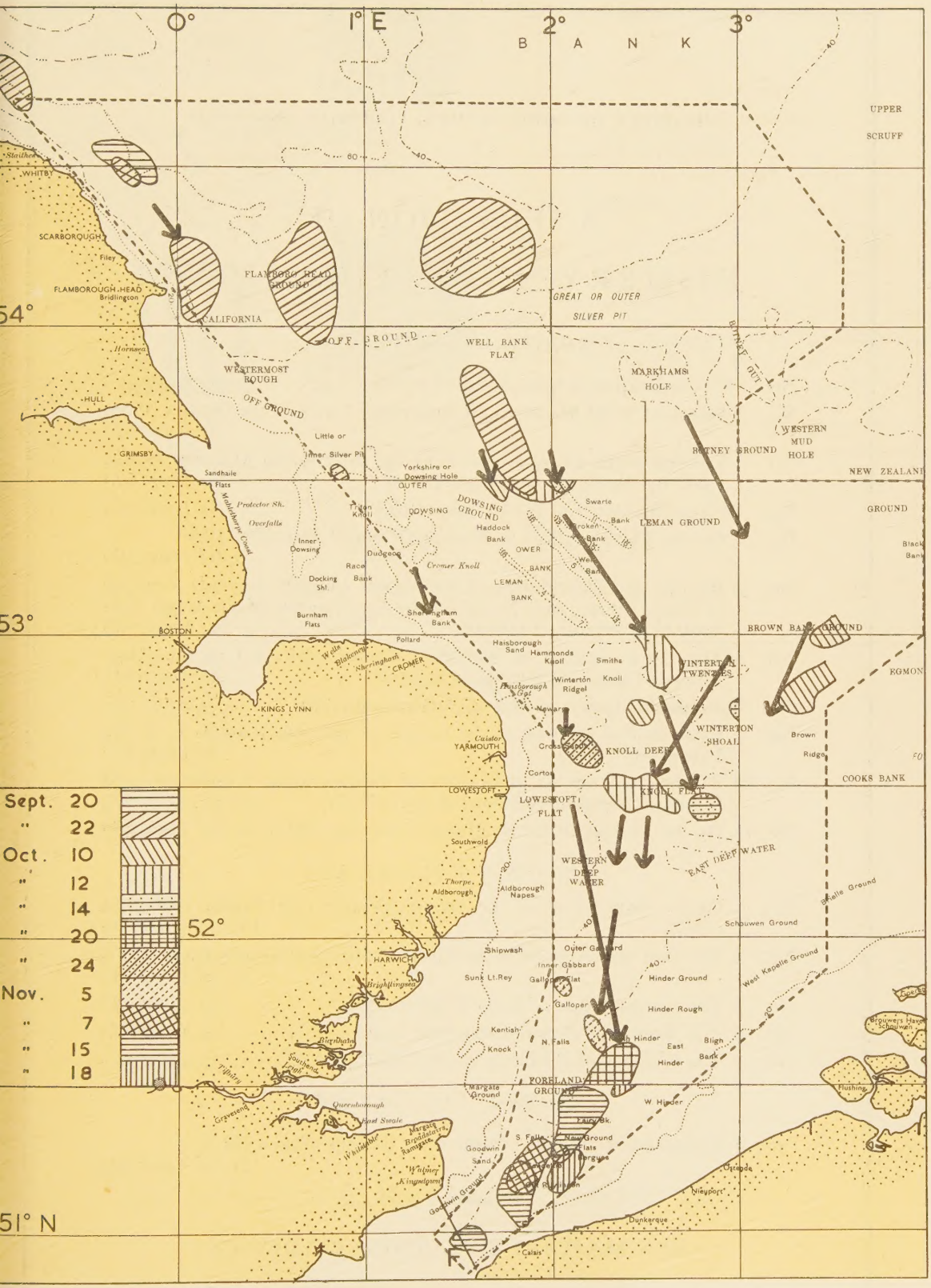


Fig. 9. *Movements of echo patches*
Arrows indicate a steady southward movement

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

A SELECTION OF

FISHERY INVESTIGATIONS

SERIES II VOLUME XX

No. 1 Triple Frequency Echo Sounder (1956) 3*s.* (*post* 4*d.*)

No. 2 Depth of Wind-Produced Homogeneous Layer in the Oceans (1956) 3*s.* (*post* 4*d.*)

No. 3 Environmental Factors Governing the Infection of Mussels, *Mytilis edulis* by *Mytilicola intestinalis* (1956) 3*s.* (*post* 4*d.*)

No. 4 Phytoplankton and the Herring (1956) 4*s.* (*post* 4*d.*)

No. 5 On the Fishing Effort in English Demersal Fisheries (1956) 7*s.* 6*d.* (*post* 5*d.*)

No. 6 Biology and Distribution of the Slipper Limpet *Crepidula fornicata* in Essex Rivers, with Notes on the Distribution of the larger Epi-Benthic Invertebrates (1956) 10*s.* (*post* 5*d.*)

No. 7 The Great Spatfall of Mussels (*Mytilus edulis* L.) in the River Conway Estuary in Spring, 1940 (1956) 5*s.* (*post* 4*d.*)

No. 8 Simplified System of Mussel Purification (1956) 5*s.* (*post* 4*d.*)

No. 9 Experimental Rearing of the Larvae of the *Ostrea edulis* L. in the Laboratory (1956) 6*s.* (*post* 4*d.*)

No. 10 Benthic Animals as Indicators of Hydrographic Conditions and Climatic Change in Svalbard Waters (1957) 22*s.* 6*d.* (*post* 6*d.*)

No. 11 On the Herring of the Southern North Sea (1957) 8*s.* 6*d.* (*post* 4*d.*)

SERIES II VOLUME XXI

No. 1 Oyster Production in the Rivers Crouch and Roach 1950-1954 (1957) 10*s.* 6*d.* (*post* 5*d.*)

No. 2 The 1951 Oyster Stock in the Rivers Crouch and Roach, Essex (1957) 8*s.* 6*d.* (*post* 4*d.*)

No. 3 The Interpretation of Echo Traces (1957) 6*s.* (*post* 4*d.*)

No. 4 The Biology of *Pandalus montagui* Leach (1957) 14*s.* (*post* 5*d.*)

No. 5 The Number of Pilchards in the Channel (1957) 6*s.* (*post* 4*d.*)

SERIES II VOLUME XXII

No. 1 Comparative Fishing Trials with Shrimp Nets 1954-56 · 5*s.* 6*d.* (*post* 4*d.*)

Obtainable from

HER MAJESTY'S STATIONERY OFFICE

at the addresses on cover page iv *or through any bookseller*

Printed in Great Britain under the authority of HER MAJESTY'S STATIONERY OFFICE
by Hydrographic Supplies Establishment

C.B.H. 31383 - Wt. 3395 - Dd. 6470 - 625 - 9/58